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EXAMINER	
BOWEN, MICHAEL WAYNE	
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/058,316	YAMAUCHI, MASAKI	
	Examiner	Art Unit	
	Michael W. Bowen	2625	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-40* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17,19-21,23,25,29-40* is/are rejected.

7)☒ Claim(s) *18,22,24 and 26-28* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *30 January 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☒ Certified copies of the priority documents have been received in Application No. 10/058,316.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *3/07/02*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 101

1. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Regarding claims 38-40, the claimed invention is directed to non-statutory subject matter. Specifically, a program is functional descriptive material not stored on a computer-readable medium (see section 2106 of the Manual of Patent Examining Procedure). A typical form for a computer related claim is shown below.

A computer-readable medium comprising instructions to...

A program stored on a computer-readable medium causing a computer to perform the steps of...

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-3, 37-38, and 40 are rejected as being anticipated by U.S. Patent 5,605,155 (Chalana et al., hereinafter called Chalana).

Regarding claim 1, Chalana reveals the following:

An ultrasonic diagnostic device (fig. 1) that generates and displays an ultrasound image (col. 4, line 11) containing an object which is subject to examination in accordance with reflection of ultrasound, the ultrasonic diagnostic device comprising

An automatic contour extracting means (col. 5, lines 35, 43-45) for extracting a final contour (i.e. derived boundary, col. 5, line 46) of the object from the ultrasound image by performing a predetermined operation (i.e. image processing functions, col. 5, line 4; use of active contour model, col. 5, line 58) on the ultrasound image,

Wherein for performing the predetermined operation, the automatic contour extracting means includes:

An initial contour extracting unit (i.e. initial boundary...is estimated, col. 5, line 43) for roughly extracting an initial contour of the object; and

A dynamic contour extracting unit (part of the image processing unit in fig. 2, item 40) for accurately extracting the final contour (i.e. optimum contour, col. 5, line 67) by using the extracted initial contour as an initial value and by applying an active contour model (col. 5, line 56) to the object within the ultrasound image.

4. Regarding claim 2, Chalana reveals the following:

The ultrasonic diagnostic device of claim 1, wherein the dynamic contour extracting unit calculates an optimum solution (i.e. optimum contour, col. 5, line 67) for the active contour model by performing iterative operation (i.e. iterative optimization method, col. 6, lines 20-21) to extract the final contour.

5. Regarding claim 3, Chalana discloses the following:

The ultrasonic diagnostic device of claim 1, wherein the automatic contour extracting means also includes

An initial contour correcting unit (col. 7, line 24; fig. 2, item 40) for judging whether the extracted initial contour meets a predetermined standard (i.e. predetermined deviation, col. 7, line 28; degree of symmetry, col. 7, line 48) and for correcting the initial contour (i.e. applies a statistical filter, col. 7, line 26) when judging that the initial contour does not meet the predetermined standard,

Wherein the dynamic contour extracting unit extracts the final contour by using the corrected initial contour as an initial value (i.e. the initial boundary ...that is input into...the active contour model, col. 7, lines 66-67).

6. Regarding claim 37, the features of this claim are found in claim 1, except that claim 37 describes means whereas claim 1 describes units. However, the means in claim 37 perform the same function as the units in claim 1, and thus they are rejected on the same basis. In addition, the predetermined operation for initial contour extraction is anticipated by Chalana (col. 6, lines 23-26).

7. The entire features of claim 38 are contained in claims 1 and 37, except that claim 38 describes a program instead of a device or means. Chalana discloses an embodiment which includes a Sun Sparcstation as a signal processor (col. 5, lines 15-16). Chalana also states that the disclosed method can be implemented on an external signal processor (col. 10, lines 1-6). Thus it is inferred that the method taught by Chalana is implemented as a program. Since the program of this claim performs the same function as the device in claims 1 and 37, this claim is rejected on the same basis.

8. The complete features of claim 40 are contained in claim 37, except that claim 40 describes a program with steps instead of a device with means. As noted in the discussion of claim 38, Chalana discloses a method implemented as a program on a signal processing system. Because the program of claim 40 performs the same function as the device of claim 37, claim 40 is rejected on the same basis as claim 37.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chalana in view of the article "PCA-based Active Contour Model For Detection And Tracking of The Left Ventricle in Apical Echocardiographic Sequences," by Halit et al. (hereinafter called Halit).

Regarding claim 4, Chalana uses the optimized contour derived from the active contour model as an initial contour for a second and third pass through the active contour model, but he does not reveal the following:

> The ultrasonic diagnostic device of claim 1, wherein the automatic contour extracting means also includes
>
> An initial contour selecting unit for storing a criterion in advance and selecting an initial contour meeting the criterion from a plurality of extracted initial contours when the initial contour extracting unit extracts the plurality of initial contours,
>
> Wherein the dynamic contour extracting unit extracts the final contour by using the selected initial contour as an initial value.

However, Halit discloses a plurality of initial contours (i.e. learning set, p. 875, section 2.2, paragraph 1) to which a criterion is applied (i.e. mean shape, p. 875, section 2.2, paragraph 3). The mean shape is used to initialize the active contour model, which produces the final contour (p. 876, section 3, paragraph 1). Chalana and Halit are analogous art because they both describe medical imaging using ultrasound images and active contours for boundary detection. Thus it would have been obvious to one skilled in the art at the time of the invention to combine the teachings of Chalana and

Halit because the method of Halit reduces the need for user input and provides greater noise immunity (abstract, paragraphs 1 and 2).

11. Regarding claim 5, Chalana does not disclose the features of this claim. However, Halit discloses the following:

> When a plurality of extracted initial contours (i.e. training set, section 2.2, paragraph 1, p. 875) meet the stored criterion (i.e. select m cardiographic images where the contour is determined manually, section 2.2, paragraph 1, p. 875), the initial contour selecting unit selects the plurality of extracted initial contours (i.e. one builds for each contour the shape vector X, section 2.2, paragraph 2, p. 875).

See the response to claim 4 for a rationale to combine Chalana and Halit.

12. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chalana in view of U.S. Patent 6,621,924 (Ogino et al., hereinafter called Ogino). Chalana does not disclose the features of claim 6; however, Ogino does disclose those features, namely:

> An external selection unit (i.e. candidate list select section, col. 14, line 52) for selecting at least one initial contour from a plurality of initial contours in accordance with dialog with an operator (i.e. the user can select a contour curve, col. 14, line 49) when the initial contour extracting unit extracts the plurality of initial contours (i.e. plurality of contour curves, col. 14, line 50),

Wherein the dynamic contour extracting unit (i.e. contour curve generator, col. 14, lines 56-64) extracts a final contour in accordance with the at least one selected initial contour as an initial value.

Chalana and Ogino are analogous art because they both describe an apparatus for contour extraction. Thus, it would have been obvious to one skilled in the art at the time of the invention to combine the features of Ogino and Chalana because user input provides more accurate contours (col. 1, lines 34-36).

13. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chalana in view of Digital Image Processing by Kenneth Castleman (hereinafter called Castleman) and Digital Image Processing by Gregory Baxes (hereinafter called Baxes). Chalana does not disclose the features of claim 7; however, Castleman discloses the following:

A density value adjusting unit (part of the image processing system on p. 3, fig. 1-3) for performing equalization (i.e. histogram equalization, pp. 91-92) on the ultrasound image to enhance contrast of the ultrasound image.

Castleman does not disclose the remaining features of claim 7, but Baxes reveals the following:

A binarization unit for converting the equalized ultrasound image into a binary ultrasound image (i.e. binary contrast enhancement, p. 75, paragraph 2); and

A degenerating unit for performing a degenerate operation on the binary ultrasound image (i.e. erosion, p. 129, paragraph 3).

Chalana, Castleman, and Baxes are analogous art because they all describe image processing methods. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the teachings of Chalana with those of Castleman and Baxes because histogram equalization is a well-known preprocessing method that aids in segmentation (Castleman, p. 91, section 6.3.1, paragraph 1), binarization is a well-known method of improving contrast (Baxes, p. 75, paragraph 2), and erosion is a standard method of removing noise from images (Baxes, p. 129, paragraph 3).

14. Claims 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chalana in view of U.S. Patent 6,381,350 (Klingensmith et al., hereinafter called Klingensmith). Chalana does not reveal the features of claim 8, but Klingensmith reveals the following:

> An initial contour input unit for obtaining an initial contour that roughly specifies the object in accordance with dialog with an operator (col. 4, lines 40-43), wherein the dynamic contour extracting unit extracts a final contour by using the obtained initial contour as an initial value (col. 4, lines 53-56).

Chalana and Klingensmith are analogous art because they both describe the segmentation of medical ultrasound images using active contours. Therefore it would have been obvious for one of ordinary skill in the art to combine the teachings of Chalana and Klingensmith because the method of allowing the user to specify an initial contour results in an accurate final contour.

15. Regarding claim 9, Chalana does not reveal the features of this claim. However, Klingensmith reveals the following:

> An automatic contour extracting means that also includes a contour selecting unit for selecting one of the initial contours obtained by the initial contour input unit and the initial contour extracted by the initial contour extracting unit (the equivalent functions of these contour processing units are described in col. 4, lines 40-52),
>
> and
>
> A dynamic contour extracting unit that extracts a final contour by using the selected initial contour as an initial value (col. 4, lines 53-56; fig. 2, item 80).

See the response to claim 8 for the motivation to combine Chalana and Klingensmith.

16. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chalana in view of U.S. Patent 6,385,332 (hereinafter called Zahalka). Chalana does not reveal the features of claim 10; however Zahalka discloses the following:

> When a time required to extract the initial contour is t1 and a time required for the dynamic contour extracting unit to extract the final contour is t2, an expression $t1 \geq t2$ is satisfied.

Specifically, Zahalka presents results from his method and he points out that the time to extract the initial contour takes longer than the time to extract the final contour (col. 12, lines 26-33). Chalana and Zahalka are analogous art because they both describe

ultrasound image segmentation using an active contour model. Thus it would have been obvious to one of ordinary skill in the art to combine the features of Chalana and Zahalka because Zahalka shows the time performance of the initialization and smoothing stages, which indicates their effectiveness.

17. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chalana. Chalana does not teach the feature of claim 11; however, it was well known that the time to perform initial and final contour extraction depends on the arrangement and complexity of the image. Therefore it would have been obvious that the processing time depends on the data and there could be situations in which $t1 \leq t2$.

18. Claims 12, 13, 23, 33-36, and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chalana in view of U.S. Patent 5,871,019 (hereinafter called Belohlavek). Chalana does not reveal the features of claim 12; however Belohlavek discloses the following:

> An automatic capacity calculating means for calculating a capacity (i.e. LV cavity volume, col. 8, lines 36-38, col. 16, lines 3, 22-25) of the object by using the extracted final contour (i.e. final fitting of the generated contour, col. 14, line 59; SOM algorithm produces final LV model, col. 13, lines 38-46; fig. 3, items 86, 92).

Chalana and Belohlavek are analogous art because they both extract contours from medical ultrasound images. Thus, it would have been obvious to one skilled in the art at

the time of the invention to combine the features of Chalana and Belohlavek because left ventricular volume is frequently used for medical diagnoses.

19. Regarding claim 13, Belohlavek reveals the following:

The ultrasonic diagnostic device of claim 12, wherein the automatic contour extracting means extracts a contour of a left ventricle of a heart as the final contour (i.e. define the LV boundary, col. 8, lines 36-38; col. 14, line 45; fig. 7) and

Wherein the automatic capacity calculating means calculates a capacity of the left ventricle (i.e. volume, col. 8, lines 36-38; LV volume, col. 16, lines 2-3).

As noted in the response to claim 12, Chalana and Belohlavek are analogous art. Therefore it would have been obvious to combine the contour extraction method of Chalana with the left ventricle analysis method of Belohlavek because automated cardiac image analysis is useful for medical diagnostics (col. 1, lines 21-26).

20. Regarding Claim 23, Chalana does not disclose the features of this claim; however, Belohlavek discloses the following:

An image normalizing means for normalizing the ultrasound image by converting the density of pixels of the ultrasound image in such a way as to make a density distribution of the ultrasound image satisfy a predetermined condition (i.e. histogram equalization, col. 11, line 26, in which the implied condition is that the range of pixel intensities is evenly distributed),

Wherein the automatic contour extracting means performs the predetermined operation on the normalized ultrasound image to extract the final contour.

Chalana and Belohlavek are analogous art as discussed previously. Thus it would have been obvious to one of ordinary skill in the art at the time of the invention to combine Chalana and Belohlavek because normalization produces a standardized set of images from which an accurate initial contour can be obtained.

21. Regarding claim 33, the first feature of this claim can also be found in claim 1, which was anticipated by Chalana, and therefore it is rejected on the same basis as claim 1. However, Chalana does not disclose the following feature of claim 33:

A three-dimensional (3D) image generating means for accumulating each generated contour to generate and display a 3D image for the object.

Belohlavek discloses this (col. 6, lines 35-40, fig. 1,7). Chalana and Belohlavek are analogous art because they both describe segmentation methods for ultrasound medical images. Thus, it would have been obvious to one of ordinary skill at the time of the invention to combine the methods of Chalana and Belohlavek because a 3D image would provide a more complete view of an object.

22. Regarding claim 34, Chalana reveals a contour extracting system that is automated (col. 5, lines 35-37), but he does not reveal the other features of this claim. However, Belohlavek discloses the following:

A contour extracting means that extracts the contour of a left ventricle of a heart from the ultrasound image (ultrasonic, col. 6, line 28-29; LV boundary, col. 8, lines 36-38) and

The 3D image generating means that displays the 3D image (col. 11, line 24) for the left ventricle (i.e. CWTR image, col. 11, lines 36-37; appendix 4, paragraph 4, lines 6-14).

As noted in the discussion of claim 33, Chalana and Belohlavek are analogous art. Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the methods of Chalana and Belohlavek because a 3D image of a left ventricle is useful for medical diagnostics.

23. Regarding claim 35, Chalana reveals the following:

An automatic contour extracting means that extracts the contour of a fetus from the ultrasound image (images of...fetus, col. 4, lines 10-12; automatic, col. 5, line 35; finding...boundaries, col. 5, line 59; ultrasound, col. 4, line 4).

Chalana does not reveal the following:

A 3D image generating means that displays the 3D image for the fetus.

However, Belohlavek reveals a means for displaying 3D ultrasound medical images, as discussed in the response to claim 34. Since Chalana and Belohlavek are analogous art as noted in the discussion of claim 33, it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the automatic contour extracting means of Chalana with the 3D imaging feature of Belohlavek to display a the 3D

contour of a fetus, because this would enable the user to more easily identify a fetus in an ultrasound image.

24. Regarding claim 36, the entire features of this claim are found in claim 1, and therefore they are rejected on the same basis as claim 1. Note that the prior art used to reject claim 1 is Chalana.

25. The entire features of claim 39 are contained in claim 33, except that claim 39 describes a program with steps instead of a device with means. However, the program performs the same function as the device, and therefore claim 39 is rejected on the same basis as claim 33. In addition, Chalana discloses an embodiment that uses a programmable signal processor (see the discussion of claim 38). Note that the prior art used to reject claim 33 is Chalana and Belohlavek.

26. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chalana in view of Belohlavek and further in view of U.S. Patent 6,458,081 (Matsui et al., hereinafter called Matsui). Chalana and Belohlavek do not disclose the features of claim 14; however Matsui does disclose the following:

A measurement display means for displaying the calculated capacity (i.e. measure, col. 11, lines 25-27, 38-39; left ventricular or LV volume, col. 13, lines 65-67 to col. 14, line 1; fig. 5, item 42).

Chalana, Belohlavek, and Matsui are analogous art because they all involve ultrasound medical images. Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to combine Matsui with Chalana and Belohlavek because the display of LV volume provides useful information for diagnosing heart problems (col. 1, lines 34-35).

27. Claims 15, 16, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chalana in view of Belohlavek, Matsui, and U.S. Patent 6,447,453 (hereinafter called Roundhill). Chalana, Belohlavek, and Matsui do not disclose the features of claim 15. However, Roundhill discloses the following:

> A real time control means for having an operation repeatedly performed at a fixed frame rate (i.e. selected frame rate, col. 7, lines 45), the operation including: (a) the extraction of the final contour by the automatic contour extracting means (i.e. the system may operate to define and display...borders drawn on real-time images); (b) the calculation of the capacity (i.e. ejection fraction, col. 8, lines 22-24); and (c) the display of the calculated capacity (col. 8, lines 26-28; fig. 8).

Chalana, Belohlavek, Matsui and Roundhill are all analogous art because they all describe ultrasound medical image processing. Thus it would have been obvious to one with ordinary skill in the art to combine Roundhill with the other cited prior art because viewing the cardiac cycle of a patient in real time is an effective way to diagnose heart problems (col. 1, lines 43-50).

28. Regarding claim 16, Chalana, Belohlavek, and Matsui do not disclose the features of this claim. However, Roundhill does disclose the following:

> An image display means for displaying at least one of the ultrasound image and the final contour (fig. 8),
>
> Wherein the real time control means controls the image display means and the measurement display means so that the calculated capacity is displayed in synchronization with the display of the at least one of the ultrasound image and the final contour (the paragraphs in col. 8, lines 15-30 explain that the ejection fraction is calculated in phase with the heartbeat, and in col. 14, lines 28-29 it is explained that the images can also be in phase with the heart, so that ejection fraction is synchronized with the image).

The motivation for combining Roundhill with Chalana, Belohlavek, and Matsui is similar to that for claim 15.

29. Regarding claim 17, Chalana, Belohlavek, and Matsui do not disclose the features of this claim. However, Roundhill does disclose the following:

> A measurement display means that displays the calculated capacity by superimposing the capacity over the at least one of the ultrasound image and the final contour (see echocardiogram with data in fig. 8).

Chalana, Belohlavek, Matsui, and Roundhill are all analogous art because they describe ultrasonic medical imaging methods. Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to combine Roundhill with the other

cited references because a superimposed display of ventrical capacity and contours would allow the observer to better judge immediate heart condition and diagnose heart problems.

30. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chalana, Belohlavek, Matsui, and Roundhill, and further in view of U.S. Patent 6,139,496 (Chen et al., hereinafter called Chen).

Regarding claim 19, which depends on claim 16, the prior art cited in claim 16 does not reveal the features of this claim. However, Chen reveals the following:

> A probe wherein at least one of the image display means and the measurement display means integrates with the probe (col. 6, lines 35-40, fig. 2).

Chalana, Belohlavek, Matsui, Roundhill, and Chen are analogous art because they all involve medical ultrasonic imaging. Thus it would have been obvious to one of ordinary skill in the art at the time of the invention to combine Chen with the prior art cited above because a probe with built-in display would allow the user to move the probe and observe the resulting image simultaneously (col. 3, lines 46-51).

31. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chalana in view of Belohlavek and further in view of U.S. Patent 6,217,520 (He et al., hereinafter called He). Chalana and Belohlavek do not disclose the features of claim 20; however He discloses the following:

An automatic contour extracting means that extracts a final contour from each of two ultrasound images corresponding to two cross sections that are orthogonal to each other (col. 7, lines 9-10), and

A capacity calculating means that uses each extracted final contour in an approximate expression to calculate a capacity, the approximate expression being pursuant to one of a modified Simpson method and a biplane area length method (col. 7, lines 16-22, where the XZ plane and YZ plane are biplanes; fig. 10).

Chalana, Belohlavek, and He are analogous art because they all involve ultrasonic medical imaging. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to combine Chalana and Belohlavek with He because the Simpson biplane method is a well-known and effective way of measuring the volume of the left ventricle.

32. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chalana in view of Belohlavek and further in view of Roundhill. Chalana and Belohlavek do not disclose the features of claim 21; however, Roundhill discloses the following:

A real time control means for having an operation repeatedly performed at a fixed frame rate (i.e. selected frame rate, col. 7, line 45), the operation including: (a) generation of the ultrasound image (col. 15, lines 42-46); (b) the extraction of the final contour by the automatic contour extracting means (i.e. borders are

calculated and displayed for every image, col. 9, lines 32-40); and (c) the calculation of the capacity (i.e. ejection fraction, col. 8, lines 26-35); and

A moving image storing means for accumulating ultrasound images generated through the repeatedly performed operation to generate and store moving images for the object (i.e. Cineloop memory, fig. 16, item 460).

Chalana, Belohlavek, and Roundhill are analogous art because they all describe image processing methods for ultrasound medical imaging. Thus it would have been obvious for one of ordinary skill in the art to combine the methods of Roundhill with those of Chalana and Belohlavek because displaying heart images and measurements in real time with the ability to store a sequence of frames for replay gives the user greater ability to identify abnormal cardiac events.

33. Claims 25, 29, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chalana in view of U.S. Patent 5,797,844 (Yoshioka et al., hereinafter called Yoshioka). Regarding claim 25, Chalana does not disclose the features of this claim; however, Yoshioka discloses the following:

A contour correcting means for correcting the final contour extracted by the automatic contour extracting means in accordance with either dialog with an operator or a standard that the contour correcting means stores (col. 8, lines 6-11; fig. 5, item 7).

Chalana and Yoshioka are analogous art because they both describe methods for extracting boundaries in ultrasound medical images. Therefore, it would have been

obvious to one of ordinary skill in the art at the time of the invention to combine the methods of Chalana and Yoshioka because contour correction improves the accuracy of the contours.

34. Regarding claim 29, Chalana does not disclose the features of this claim; however, Yoshioka discloses the following:

> An automatic capacity calculating means for calculating a capacity of the object by using the corrected final contour (col. 8, lines 16-20).

Chalana and Yoshioka are analogous art as noted previously. Thus it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the features of Chalana and Yoshioka because contour correction produces more accurate calculations of heart capacity.

35. Regarding claim 30, Chalana does not disclose the features of this claim; however, Yoshioka discloses the following:

> A 3D image generating means for accumulating each corrected final contour to generate and display a 3D image for the object (col. 17, lines 41-44; corrected 3D heart wall contour, col. 17, lines 61-62).

Chalana and Yoshioka are analogous are as previously noted. Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the features of Chalana and Yoshioka because a 3D image with corrected contours would provide a more informative view of the heart.

36. Claim 31 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chalana in view of U.S. Patent 6,785,409 (hereinafter called Suri). Regarding claim 31, Chalana does not disclose the features of this claim; however, Suri discloses the following:

> An automatic contour extracting means that extracts the contour by using previously extracted contours (col. 1, lines 57-61).

Chalana and Suri are analogous art because they both describe methods for extracting contours from medical images. Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the methods of Chalana and Suri because the use of previously extracted contours would produce more accurate final contours.

37. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chalana and Suri and further in view of U.S. Patent 5,570,430 (Sheehan et al., hereinafter called Sheehan). Chalana and Suri do not reveal the features of claim 32. However, Sheehan reveals the following:

> An automatic contour extracting means that extracts the contour (col. 6, lines 39-44) by performing an operation using the contours which have been previously extracted from ultrasound images (col. 7, line 17) corresponding to a plurality of frames (col. 14, lines 55-56), the operation being at least one of: (a) interpolation into the frames (col. 14, lines 57-59); (b) OR operation being performed on each ultrasound image for which binarization has been conducted; (c) AND operation

being performed on each ultrasound image for which binarization has been conducted; and (d) estimation of movement (i.e. displacement, col. 14, lines 59-67).

Chalana, Suri, and Sheehan are analogous art because the all describe the estimation of contours in medical ultrasound images. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the method of Sheehan with those of Chalana and Suri because the extraction of contours from multiple time frames reveals the motion of the heart and produces more accurate contour estimates (col. 6, lines 39-44; col. 14, lines 31-32).

Allowable Subject Matter

38. Claims 18, 22, 24, and 26-28 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

39. The following subject matter could not be found in the prior art:

Claim 18

The ultrasonic diagnostic device of Claim 17, wherein the measurement displaying means displays the capacity while leaving previously calculated capacities displayed to thereby display transition of capacity over time.

Claim 22

The ultrasonic diagnostic device of Claim 12, further comprising wherein a real time control means includes a frame rate control unit for monitoring the operation and changing the frame rate to have the operation completely performed.

Claim 24

The ultrasonic diagnostic device of Claim 23,

Wherein the normalizing means includes:

A Condition storing unit for storing the predetermined condition in advance;

A density converting unit for converting the density of the pixels by using a plurality of transform functions to generate a plurality of ultrasound images; and

A Control judging unit for specifying, out of the plurality of ultrasound images, an ultrasound image that satisfies the stored predetermined condition, and outputting the specified ultrasound image as a normalized ultrasound image.

Claim 26

The ultrasonic diagnostic device of Claim 25, further comprising,

A use ascertaining means for determining, for one of the extracted final contour and the corrected final contour, whether the final contour is used for subsequent operation in accordance with dialog with the operator.

Claim 27

The ultrasonic diagnostic device of Claim 26, further comprising

An automatic capacity calculating means for calculating a capacity of the object by using the final contour determined to be used by the use ascertaining means.

Claim 28

The ultrasonic diagnostic device of Claim 27, further comprising

A three-dimensional (3D) image generating means for accumulating each final contour determined to be used so as to generate and display a 3D image for the object.

40. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael W. Bowen whose telephone number is (571)272-5969. The examiner can normally be reached on M-F 8AM-5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta can be reached on (571)272-7453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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